## **CLAIMS**

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A substrate, suitable for the preparation of a composite membrane, which substrate comprises a porous matrix of fibres, characterised in that the fibres are bound with a binder comprising both silica and a fluorinated hydrocarbon polymer.

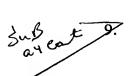
2. A substrate according to claim 1, wherein the silica comprises a colloidal aqueous solution, or a silica powder dispersed in water.

polymer comprises one or more non-ion-conducting polymer(s).

A substrate according to claim 1 or claim 2, wherein the fluorinated hydrocarbop

- 4. A substrate according to any preceding claim wherein the non-ion-conducting polymer is selected from the group consisting of polytetrafluoroethylene (PTFE), fluorinated ethylene-propylene (FEP), tetrafluorethylene-ethylene (ETFE) copolymers, poly(vinylfluoride) (PVF) and poly(vinylidinefluoride) (PVDF).
- 5. A substrate according to any preceding claim, which comprises a colloidal silica:PTFE mixed binder.
- 6. A substrate according to any preceding claim, wherein the ratio of silica to polymer is in the range of from 95:5% to 5:95% based on w/w solid materials in the binder mixture.
- 25 7. A substrate according to claim 6 wherein the ratio of silica to polymer is in the range of from 70:30% to 30:70% based on w/w solid materials in the binder mixture.

A substrate according to claim 6 or claim 7 wherein the ratio of silica to polymer is about 50:50%, based on w/w solid materials in the binder mixture.



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A substrate according to any preceding claim, wherein the mixed binder is in the form of a dilute aqueous dispersion.

- 10. A substrate according to claim 9 wherein the mixed binder is in the form of a dilute aqueous dispersion of about 10wt% solids in the aqueous solution.
- 11. A substrate according to any preceding claim, wherein the fibres comprises glass and/or silica.
- 10 12. A substrate according to any preceding claim, wherein the fibres have a diameter in the range of from 0.1μm to 50μm.
  - A composite membrane comprising a porous substrate of fibres and at least one ion-conducting polymer, characterised in that the porous substrate comprises fibres that are bound with both silica and a fluorinated hydrocarbon polymer.
  - 4. A membrane according to claim 13 which, when tested by the method described herein in the Examples, results in less than or equal to about ±16% change in its area; preferably, ≤ ±10% area change; more preferably, in the range of from about 0 to about 6% expansion.
  - 15. A process for preparing a porous substrate according to any one of claims 1 to 12, which process comprises applying an aqueous dispersion of silica and a fluorinated hydrocarbon polymer to a porous matrix of wet fibres.
  - 16. A process for the manufacture of a substrate according to any one of claims 1 to 12, which process comprises
    - (a) dispersing the fibres in water to form a slurry:
    - (b) depositing the slurry onto a mesh bed to form a network;
  - (c) drying and compacting the fibre network; and
    - (d) applying, before or after step (c), a dispersion of the binder.

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A process for the manufacture of a membrane according to claim 13 or claim 14, which process comprises

- (i) forming a porous substrate of, preferably randomly orientated individual, mixed amorphous silica fibres bound with a binder by a process according to claim 16; and, thereafter,
- (ii) impregnating the fibre matrix substrate with a polymeric material to produce a membrane.
- 10 18. A process according to claim 17, wherein step (ii) is carried out by nip roller coating of the substrate to fill it with a solution of ion-conducting polymeric material, and further compaction and drying of the membrane.

A membrane electrode assembly comprising a substrate according to any one of claims 1 to 12 and/or a composite membrane according to claim 13 or claim 14.

20. A fuel cell comprising a substrate according to any one of claims 1 to 12 and/or a composite membrane according to claim 13 or claim 14.

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